



## CONTENTS

MOLECULAR TRANS-SPECIES POLYMORPHISM, <i>Jan Klein, Akie Sato, Sandra Nagl, and Colm O'hUigin</i>	1
PRINCIPLES OF PHYLOGEOGRAPHY AS ILLUSTRATED BY FRESHWATER AND TERRESTRIAL TURTLES IN THE SOUTHEASTERN UNITED STATES, <i>DeEtte Walker and John C. Avise</i>	23
THE FUNCTIONAL SIGNIFICANCE OF THE HYDROHEIC ZONE IN STREAMS AND RIVERS, <i>Andrew J. Boulton, Stuart Findlay, Pierre Marmonier, Emily H. Stanley, and H. Maurice Valett</i>	59
ENDANGERED MUTUALISMS: THE CONSERVATION OF PLANT-POLLINATOR INTERACTIONS, <i>Carol A. Kearns, David W. Inouye, and Nickolas M. Waser</i>	83
THE ROLE OF INTRODUCED SPECIES IN THE DEGRADATION OF ISLAND ECOSYSTEMS: A CASE HISTORY OF GUAM, <i>Thomas H. Fritts and Gordon H. Rodda</i>	113
EVOLUTION OF HELPING BEHAVIOR IN COOPERATIVELY BREEDING BIRDS, <i>Andrew Cockburn</i>	141
THE ECOLOGICAL EVOLUTION OF REEFS, <i>Rachel Wood</i>	179
ROADS AND THEIR MAJOR ECOLOGICAL EFFECTS, <i>Richard T. T. Forman and Lauren E. Alexander</i>	207
SEX DETERMINATION, SEX RATIOS, AND GENETIC CONFLICT, <i>John H. Werren and Leo W. Beukeboom</i>	233
EARLY EVOLUTION OF LAND PLANTS: PHYLOGENY, PHYSIOLOGY, AND ECOLOGY OF THE PRIMARY TERRESTRIAL RADIATION, <i>Richard M. Bateman, Peter R. Crane, William A. DiMichele, Paul R. Kenrick, Nick P. Rowe, Thomas Speck, and William E. Stein</i>	263
POSSIBLE LARGEST-SCALE TRENDS IN ORGANISMAL EVOLUTION: EIGHT "LIVE HYPOTHESES," <i>Daniel W. McShea</i>	293
FUNGAL ENDOPHYTES: A CONTINUUM OF INTERACTIONS WITH HOST PLANTS, <i>K. Saikkonen, S. H. Faeth, M. Helander, and T. J. Sullivan</i>	319

FLORAL SYMMETRY AND ITS ROLE IN PLANT-POLLINATOR SYSTEMS: TERMINOLOGY, DISTRIBUTION, AND HYPOTHESES, <i>Paul R. Neal, Amots Dafni, and Martin Giurfa</i>	345
VERTEBRATE HERBIVORES IN MARINE AND TERRESTRIAL ENVIRONMENTS: A NUTRITIONAL ECOLOGY PERSPECTIVE, <i>J. H. Choat and K. D. Clements</i>	375
CARBON AND CARBONATE METABOLISM IN COASTAL AQUATIC ECOSYSTEMS, <i>J.-P. Gattuso, M. Frankignoulle, and R. Wollast</i>	405
THE SCIENTIFIC BASIS OF FORESTRY, <i>David A. Perry</i>	435
PATHWAYS, MECHANISMS, AND RATES OF POLYPLOID FORMATION IN FLOWERING PLANTS, <i>Justin Ramsey and Douglas W. Schemske</i>	467
BACTERIAL GROWTH EFFICIENCIES IN NATURAL AQUATIC SYSTEMS, <i>Paul A. del Giorgio and Jonathan J. Cole</i>	503
THE CHEMICAL CYCLE AND BIOACCUMULATION OF MERCURY, <i>François M. M. Morel, Anne M. L. Kraepiel, and Marc Amyot</i>	543
PHYLOGENY OF VASCULAR PLANTS, <i>James Doyle</i>	567
INDEXES	
Subject Index	601
Cumulative Index of Contributing Authors	620
Cumulative Index of Chapter Titles	622

## SUBJECT INDEX

### A

ABC model of organ identity, 352–53  
Abdel-Hameed, F, 489  
*Abies*, 454  
*Acanthisitta chloris*, 143  
*Acarapsis woodi*, 92  
Accretion rates, 185  
Accumulation-attrition model for sex determination, 245  
*Achillea millefolium*, 477  
Acid lysis  
  digestion by, 386  
*Aconitum napellus*, 362  
*Acrocephalus luscinia*, 120  
*A. melanopogon*, 144  
*A. scelentensis*, 150  
*A. vaughani taiti*, 160  
Actinomorphy, 348–49, 351  
Activity patterns of pollinators, 364–67  
Adams, C, 24  
Adaptedness trends, 304–6  
Adaptive explanations for help, 145, 147–62  
  access to mates, 154–59  
  acquisition of skills, 161–62  
  enhanced production of nondescendant kin, 147, 149–52  
  formation of alliances, 160–61  
  improvement of local conditions, 159–60  
  payment of rent, 152–54  
Adaptive Management Areas (AMAs)  
  setting aside, 452  
Adaptive suites and floral symmetry, 354  
*Aerodramus vanikorensis bartschi*, 114  
Agents of selection, 16  
*Aglaophyton*, 280  
Agricultural practices  
  changes in, 97–98  
  effects on wild pollinators, 89–90  
Aizen, MA, 88  
Alatoconchids, 196  
*Alces*, 223  
Algae  
  benthic, 67  
  coralline, 199–200  
  dietary, 395  
  putative, 188  
  reef-associated, 200  
  upwelling water promoting activity in, 67  
Allee effect, 87  
Alleles  
  under balancing selection, 4  
  under directional selection, 4  
  gene pool frequency, 9  
  sex-linked, 166  
  similar, 1  
Allelic lineages  
  agents of selection, 16  
  age of, 10–12  
  concept of, 9–10  
  diversification of, 14–16  
  HLA-DRBI, 5, 11, 15–16  
  Mhc-DRBI, 17  
  number of, 10, 12–14  
  oldest, 12, 16  
  trimmed form of, 14  
Alliances  
  facilitating formation of, 160  
  improving prospect of reproduction, 160–61  
*A. fistolus*, 473  
*Allium cepa*, 473  
Allopolyploid formation, 467, 470–71  
  and disturbed habitats, 489  
  estimating the rate of, 489–94  
  via hybridization of autopolyploids, 473  
  via hybridization of different cytotypes, 473–74  
Allotetraploid formation  
  one-step, 473  
  triploid-bridge, 472–73  
Allozyme diversity, 25, 440–41  
Allozyme heterozygosity and polymorphism, 88  
Alluvial aquifers  
  interacting with hyporheic zone, 61  
Altenberg, L, 302  
AMAs  
  See Adaptive Management Areas  
*Amia calva*, 52  
Ammonification, 63  
Amon, RMW, 521  
Amylases in herbivorous fish, 388  
Anabolism coupled with catabolism, 507–8  
Anatomical phase of plant evolution, 265–66  
Ancestral polymorphism, 2  
Ancestral polymorphism vs convergence, 17  
Ancient reef ecosystems  
  complexity of, 184–88  
  and photosymbiosis, 195–97  
Aneuploids  
  common, 486  
  differences among, 471  
  role in polyploid formation, 495  
Angermeier, PL, 444  
Angiosperms, 586–94  
  eudicots, 589–93  
  monocots, 593–94  
outcrossing in, 6  
pollination of, 84  
relationships among, 586–89  
storing oceanic buried carbon, 413  
Animal behavior in plant-pollinator systems, 345–69  
Animal movement patterns  
  adjacent to roads, 211–12, 225  
Animal pollinators  
  ecology of, 101  
  interactions with plant pollinators, 102  
*Ankyropteris*, 573  
*Anolis carolinensis*, 114  
irruption on Guam, 124  
Anoxic waters and sediment mercury in, 555–59  
Anthocerotes, 569  
Anthropogenic activities  
  effect on coastal zones, 408  
  sources of mercury, 546  
Antipredation mechanisms, 199  
*Anthrithrum majus*, 352–53  
*Aphelocoma coerulescens*, 149  
*Apis mellifera*, 92–93, 98  
*Apodacrylus punctatus*, 389  
*Aponis opaca*, 114  
Apocynaceae, 350  
Aquatic ecosystems  
  bacterial growth efficiency in, 503–34  
  carbon and carbonate metabolism in, 405–27  
  distribution of macrophytes in, 68  
*A. flavellata*, 472, 483

*Aquilegia chrysanthia*, 472, 483  
 Arber, EAN, 581  
 Archaeocysts, 186  
*Archaeolithophyllum*, 200  
*Archaeolithoporella*, 187–88  
*Archaeopteris*, 277, 575–76  
 Archean, 184  
*Aristolochiaceae*, 593–95  
 Arizona-Sonora Desert Museum, 100  
*Armadillidium vulgare*, 249–50  
 Assimilation of nutrients, 389–90  
 Asteraceae, 87, 358  
 Atlan, A, 251  
 Atmospheric mercury, 545  
*Australagus monoensis*, 90  
*Australopithecus*, 8  
 Autocatalytic chemical cycles, 299–300  
 Autophosphorylation of serine and threonine residues, 6–7  
 Autopolyploid formation, 467, 470–71  
 estimating the rate of, 489–95  
 success in crossing barriers, 479  
 Autotetraploidy, 467  
 one-step, 472  
 rate of formation, 492  
 triploid-bridge, 472  
 Avise, JC, 39

**B**

Backcrossing, 472, 474, 484  
 Bacterial assemblages  
 natural, 524–29  
 Bacterial cultures with defined media  
 coupling between catabolism and anabolism, 507–8  
 maintenance energy, 506–7  
 Bacterial exopolymers, 526  
 Bacterial growth efficiency (BGE) in bacterial cultures with defined media, 506–8  
 conceptual framework, 505–6  
 effect of temperature, salinity, pressure, 517–18  
 energy and organic carbon limitation, 519–24  
 measuring, 504–5, 508–10  
 in natural aquatic systems, 503–34, 508–17  
 nutrient limitation, 518–19  
 patterns in, 510–15  
 regulating, 517–24  
 relationship between growth rate and growth efficiency, 515–17  
 Bacterial respiration (BR), 503  
 Bacterial secondary production (BP), 503  
 Bacterioplankton growth efficiency regulating, 517–24  
 Baker, FS, 435  
 Balanced trans-species polymorphism (TSP), 2, 4–17  
 allelic lineages and, 9–16  
*Mhc* class I and class II loci, 4–5, 11–12  
 properties of, 9–17  
 of self-incompatibility loci, 6–8  
 Balancing selection alleles under, 4  
 interallelic differences under, 9–10  
*Banksia*, 87, 366  
 Barbehenn, KR, 123  
 Barrier effect, 207  
 Barriers to gene flow long-term historical, 48  
 Base pair (bp) substitution, 3  
 Bateman, RM, 265–66, 282, 287, 569  
 Bats loss of on Guam, 114, 121, 130  
 Bauchop, T, 506  
 Beck, CB, 575  
 Bees declines of, 83  
 factors favorable to, 89  
 pollination by, 354  
 providing habitat for, 96  
 repelling during pesticide spraying, 98  
 in urban areas, 96  
 Behavioral phase of plant evolution, 266  
 Bellinger, J, 477  
 Bellwood, DR, 387, 389, 391  
 Bénard convection cell, 299  
 Benavides, AG, 389  
 Ben-Bassat, D, 553  
 Beneficial biotic agents, 84  
 Benner, R, 518, 521  
 Bennett, AF, 208  
 Benthic algal composition, 185  
 altering, 67  
 respiration attributable to, 410, 412, 415–16  
 Berman, T, 510  
*Beta vulgaris*, 473  
 BGE See Bacterial growth efficiency  
 Bierregaard, RO Jr, 89  
 Bioaccumulation of mercury, 543–63  
 inorganic vs organic, 562  
 Biochemical phase of plant evolution, 265  
 Bioconcentration of methylmercury, 543–63  
 Biodiversity crisis in Guam, 113–37  
 evaluation of ecological impacts, 114–19  
 extreme extent of, 131–33  
 factors other than introduced species, 130–31  
 history of, 119–30  
 introduction of snake and, 114  
 prognosis, 133–37  
 Bioerosion rise in reef, 197–201  
 Biogeochemistry of the coastal ocean, 406  
 Biological effects of fragmentation, 86–88  
 Biomagnification of mercury in the food chain, 560–62  
 Biome-based conservation efforts, 54  
 Biosphere 2, 97  
 Biotas See Land biotas  
 Biotic agents beneficial, 84  
 Birds breeding cooperatively, 141–68  
 near extermination on Guam, 114  
 traffic noise levels that disturb, 214–15  
 Bivalves alatoconchid, 196  
 Bjorndal, KA, 391  
 Blakeslee, AF, 482  
 Blood group antigens trans-species polymorphism in, 8  
 Boettcher, AA, 390  
*Boiga irregularis*, 113, 114, 131  
*Bombus diversus*, 93, 362  
*B. oleracea*, 7, 488  
*B. terrestris*, 90, 93, 99  
 Bond, WJ, 87  
 Bonner, JT, 306  
 Boundaries blurring, 320  
 Bowen, SH, 384  
 Bowers, KAW, 365  
 BP See Bacterial secondary production  
 Bp See Base pair (bp)  
 BR See Bacterial respiration  
 Brachiopods, 191  
 Branch-time line intersections, 9  
*Brassica campestris*, 6–7, 488

Bretagnolle, F, 476  
 Bridges, CB, 237  
*Brighamia*, 97  
 Broadcast burning, 445, 450  
 Brood size  
 suboptimal, 166  
 Brown, JL, 167–68  
 Brown, SW, 244  
 Bryophytes, 268, 271–72  
 Bryophytic phase, 265  
 Bryozoa, 193–201  
 frondose, 187–88  
*Bucorvus leadbeateri*, 162  
 Buffer strips between roads and  
 streams, 219  
 Bull, JJ, 237, 244  
 Burd, M, 86  
 Bureau of Land Management, 438  
 Burgess, RL, 453  
 "Buzz pollination," 99

**C**

Calcium magnesium acetate  
 (CMA) as road deicer, 219–20  
 Calder, DM, 96  
*Callistemon rugulosus*, 94  
*Callistophyton*, 575–76, 578  
*Calochortus longebarbatus*, 486  
*Calocitta formosa*, 149  
 Cambrian, 179, 185–86, 201, 263  
 radiation of metazoan marine  
 animals, 283, 287  
 Campbell, EW III, 132  
*Canis lupus*, 222  
*Carassius auratus*, 385  
 Carbonate metabolism in aquatic  
 ecosystems, 405–27  
 Carbonate-secreting marine  
 organisms, 184  
 Carbon cycle  
 See Oceanic carbon cycle  
 Carboniferous, 191, 196, 200,  
 266, 269–71, 275–78, 573,  
 575, 578, 586  
 Carbon limitation of  
 bacterioplankton growth  
 efficiency, 519–24  
 Carbon metabolism  
 in aquatic ecosystems, 405–27  
 in soil biology, 446  
 sources and quality of organic  
 substrates, 521–24  
 Carbon sinks, 417  
*Carlia cf fusca*, 115  
 irruption on Guam, 125–26  
 Carlson, CA, 520, 522, 532  
 Carrion feeders, 212  
 Carroll, GC, 325, 333  
 Case, TJ, 133  
 Catabolism coupled with  
 anabolism, 507–8  
*Catarrhini*, 11–12, 17  
 Catchment-scale processes, 71–74  
 ecological studies of the  
 hyporheic zone, 72–73  
 and the hyporheic corridor  
 concept, 71–72  
*Cathartaca lönbergi*, 160–61  
 Cation transporters  
 transmembrane, 559  
*Caytonia*, 582–84  
 Cazemajor, M, 248  
 cDNA, 12  
*Cebrián*, J, 413  
 Cellulose, 381, 383  
 Cenozoic, 179, 197, 200–1  
*Centris*, 88  
*Cephalotaxus*, 580  
*Cervus elaphus*, 243  
*Ceryle rudis*, 147, 151  
 Chaloner, WG, 277  
 Channel morphology  
 and discharge, 69  
 dynamic, 60  
 Character-state acquisition  
 patterns, 263  
*Chara hummocks*, 68  
 Charales, 267  
 Charnov, EL, 165  
 Charophyceae, 267  
 Charophytes, 569  
 Chaw, SM, 581  
 Cheating, 161  
*Chelydra serpentina*, 41, 45–46,  
 48–49, 54  
 Chemical cycles  
 autocatalytic, 299–300  
 of mercury, 543–63  
 Chemical transport along roads,  
 219–21  
 Chemistry of mercury  
 in anoxic waters and sediment,  
 555–59  
 chemical speciation in anoxic  
 waters, 555–56  
 chemical speciation in oxic  
 waters, 546, 549–51  
 demethylation reactions, 554  
 methylation, 557–59  
 oxidation of elemental mercury,  
 554  
 reduction of Hg(II), 551–53,  
 556–57  
 sources of methylmercury in  
 surface waters, 554–55  
 in surface waters, 546–55  
 Chemostat culture, 506  
 Cherrier, J, 520  
 Chicago Botanic Garden, 97  
 Chimpanzees, 5, 11, 158  
*Chiroxiphia linearis*, 160  
 Chitika, L, 354  
*Chlorella*, 553  
*Chlorurus*, 387  
*Chrysemys picta*, 48  
*Chrysomya rufifacies*, 239, 241  
 Cichlid fishes, 1, 3, 13, 18  
 Cinnabar, 555–56  
 CITES  
 See Convention on International  
 Trade in Endangered  
 Species of Wild Fauna and  
 Flora  
 Clade-level properties, 306  
 Cladistic phylogenies, 263–64  
 Cladogram topology, 278  
 Cladoxyllopsids, 573  
 Clark, Anne Barrett, 164  
*Clarkia amoena*, 87, 489  
*C. lassendenensis*, 489  
 Class I and class II loci, 4–5, 11  
 Classical genes, 4  
 Clausen, RE, 471  
 Clavicipitaceus fungal  
 endophytes, 320  
 Clay, K, 330, 334  
 Clear-cutting, 448–50  
*Clermontia arborescens*, 99  
 Clonal propagation, 102  
*Cloudina*, 185  
 Cnidarians, 186  
 Coalescences  
 patterns of, 10  
 scoring, 9  
 Coastal zones  
 biogeochemistry of, 406  
 continental shelf, 421–23  
 coral reefs, 418–21  
 estuaries, 409–12  
 importance to global oceanic  
 carbon cycle, 423–26  
 macrophyte-based ecosystems,  
 412–14  
 mangroves, 414–17  
 metabolism within, 405–27  
 river input, 408–9  
 statistics about, 406  
 Coccoidea, 253–54  
 Coding sites, 1  
 of thioredoxin H protein, 7  
 Codon positions, 10  
 See also Allelic lineages  
 Coen, ES, 352  
 Coercion, 152  
 Coexistence of infected and  
 uninfected host plants, 334  
 Coffin, RB, 515  
 Cole, JJ, 513, 515, 517, 530, 532  
*Coleochaete orbicularis*,  
 267, 569

Collateral kinship  
See Cooperative polyandry

Communities  
autotrophic, 194  
defined, 183  
heterotrophic, 194

Community effects of endophytes, 328-31

Community metabolism, 415, 418

Competition  
low-compensation landscape, 263  
and vegetation management, 441-42

Complexity-constancy hypothesis of floral symmetry, 363-64

Complexity-neuronal/behavioral sophistication hypothesis of floral symmetry, 361-63

Complexity trends, 304, 306  
vs progress, 314

Concordance  
across characters within a gene, 48  
genealogical, 23, 48-50

Conflict  
among cooperatively breeding birds, 166  
defined, 235-36

Conifers, 575, 579-80

Connectance  
among large-scale trends, 306-7  
in a food web, 85

Conservation  
of habitats, 95-96  
of insect species, 103  
of plant-pollinator interactions, 83-103

Conservation biology, 23, 102

Conservation efforts  
biome-based, 54  
ecosystem-based, 95  
habitat-based, 95

Continental shelf, 421-23

Continuous-culture techniques, 506

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), 100

*Cooksonia*, 270

Cooperatively breeding birds  
conflict among, 166  
evolution of helping behavior in, 141-68

Cooperative polyandry and cooperative families, 142-44

Cooperative societies  
combinations of helping within, 143-44

Cope's rule, 294, 306, 309

*Corallina elongata*, 386

Coral reef ecosystems  
and coastal zones, 418-21  
herbivorous fishes in, 378-81  
origins of modern, 194-201

*Corvus kubaryi*, 114

Cosmides, ML, 236

Costanza, R, 459

Costs  
of helping behaviors, 144-45  
metabolic, 333-34  
of parental care, 145

*Costus speciosus*, 472

Coupling between catabolism and anabolism in bacterial cultures with defined media, 507-8

Courtship  
extra-group, 152

Cox, PA, 99

Craig, JL, 160

Crane, PR, 268, 281-82, 285, 570, 573, 582

*Crepis capillaris*, 470

Cretaceous, 181, 184, 197, 199, 269, 590

Cretaceous-Eocene, 201

*Crinodus lophodon*, 389

Crinoids, 193-94

Crisis  
See Pollination crisis

Cronk, QCB, 87

Cronquist, A, 586, 589

Cropper, SC, 96

Crossland, CJ, 419-20

*Crotophaga sulcirostris*, 143

Cruciferae, 5

Cryptobionts, 188

*Cryptoblepharus poecilopleurus*, 131

*Ctenochætus striatus*, 387

Cyanobacteria, 311  
calcified, 185-86  
living, 190

Cycadophytes, 575

Cycads, 578-79

*Cynoglossum officinale*, 87

Cyprinidae, 12

Cytokinesis, 474

Cytological anomalies, 475

Cyto-nuclear conflict, 242

Cytoplasmic male sterility (CMS), 233, 235  
in plants, 250-52

Cytoplasmic sex-ratio distortion, 233  
in animals, 248-50

## D

*Dactylis glomerata*, 475, 480

Dahlgren, RMT, 593-94

Dangerous lower margin hypothesis of floral symmetry, 366-67

*Danio albolineatus*, 13

*D. rerio*, 13

Darcy's Law, 69

"Darwinian perspective," 86

Dateable insertion elements, 12

*Datura stramonium*, 469, 477, 482

Davenport, D, 356

Davies, NB, 142

Dawkins, R, 236

Degassing from geological formations, 546

Degradation of island ecosystems, 113-37

*Deirochelys reticularia*, 39, 41, 43, 49-50

Deletions, 39

Demethylation  
of mercury, 554  
partial, 545

Demographic stochasticity, 86

Denitrification, 63-64, 423

Density-related declines, 87

Depression inbreeding, 86, 154

*Desulfovibrio desulfuricans*, 558

Detrivorous fauna, 185

Developmental cascades, 303

Developmental depth trends, 302-4

Developmental entrenchment, 313

Development of floral symmetry and molecular genetics, 352-53

Devonian, 190-93, 266-67,  
269-78, 281-86, 569-70,  
572-73, 586  
paleoecology of, 276-78

Devonian-Carboniferous, 576, 586

de Wet, JMJ, 475

Diagenesis, 181

*Dianthus deltoides*, 88

*Dicranus macrocerus*, 114  
irruption on Guam, 124-25

Diet quality for herbivores, 381-86  
feeding patterns, 383-85  
food selection, 385-86  
plant assemblages, 383-85  
positive and negative choices, 381-83

**Digestion and assimilation**  
assimilation of nutrients, 389–90  
digestive enzymes, 388  
food intake rate, 390–91  
gut passage rate, 391  
role of microbial symbionts, 388–89

**Digestive mechanisms**, 386–87  
acid lysis, 386  
microbial fermentation, 387  
titration in a gizzard-like stomach, 386–87  
titration in pharangeal jaws, 387

**Digestive physiology**, 375

*Digitalis ambigua*, 470, 473

*D. purpurea*, 470, 473

**Dimerization of SRK molecules**, 6

**DiMichele, WA**, 277

**Diplods**  
crossing with tetraploids, 478  
progenitor, 479  
recovering, 486

**Diptera**, 96

**Directional selection**  
alleles under, 4

**Dispersal**  
dynamics of, 163  
joint, 164  
and sex-biased helping behavior, 162–65

**Dispersal epiphenomenon**  
hypothesis, 164

**Dissipative structures**, 299–300

**Dissolved organic carbon (DOC)**  
competitive inhibitor for solar radiation, 553  
monitoring changes in, 509–10  
in natural aquatic systems, 525

**Distribution of reefs**  
physicochemical controls on, 184

**Disturbances**  
resistance to, 453–55

**Divalent mercury in surface water**, 549–50

**Divergence**, 39  
in nucleotide sequence, estimated, 28

**Divergence time**, 5  
estimating using minimum-minimum method, 10

**Diversity**  
allozyme, 25, 440–41  
in faunal composition, 191  
genetic, 457  
habitat, 211  
and intensive forestry, 450–53  
phenotypic, 263

of plant community, 319  
species, 263

**DNA**  
mitochondrial, 3  
nuclear, 3  
polymorphism in, 3, 8  
See also cDNA; mtDNA

**DNA sequence data from extant relatives**, 263

**DOC**  
See Dissolved organic carbon

**Domestication of wild bees and other pollinators**, 99–100

**Dominance hierarchy**, 154  
among males, 143, 164  
intersexual, 153

*Donoghuie, MJ*, 582, 588

*Doyle, JA*, 281, 582, 586, 588

**DRIS norms**, 443

**Driven large-scale trends**, 307–9

*Drosophila melanogaster*, 234, 237, 239, 241, 246–48

*D. simulans*, 248

*D. willistoni*, 248

**Duarte, CM**, 413

**Ducklow, HW**, 520, 522, 532

**Duggins, DO**, 384

**Dukas, R**, 362

**Dulberger, R**, 367

**Dungern, E von**, 5, 8

**Dynamic channel morphology**, 60

**Dynamics of evolving taxa**, 297–98

**Dyploidy**, 471

**E**

**Eames, AJ**, 582

**Ebenhard, T**, 132

**Eckman, JE**, 384

**Ecological consequences**  
of endophytic fungi, 324–26  
of patterns in bacterial growth efficiency (BGE), 529–33

**Ecological evolution of reefs**, 179–201

**Ecological flows**, 207

**Ecological impacts**  
evaluation of, 114–19  
influencing endophyte interactions, 331–36  
nutritional ecology and, 375–97  
of roads, 207–26

**Ecosystem management (ET)**, 455–57

**Ecosystems**  
concerns facing, 102  
degradation by introduced species, 113–37  
effect of endophytes, 319–36

keystone role of pollinators, 102  
macrophyte-based, 412–14  
See also Aquatic ecosystems; Coastal zones; Reef ecosystems

**Ecotone model**  
dynamic, 60

**Ectothermic metabolism**, 380, 395

**Edge**  
amount of, 86  
generation of new, 88

**EDGs**  
See Evolutionary development gates

**Edwards, D**, 265

**Efficiency**  
See Growth efficiency

**Ehrendorfer, F**, 590

**Einset, J**, 472

**Elsden, SR**, 506

*Emballonura semicaudata*, 120

**Embryophytes**, 569

**Emerson, S**, 7

**Emlen, ST**, 142, 147, 157

*Emoia caeruleocauda*, 114

*E. slevini*, 123

**Enantiomorphy**, 350  
evolution of, 365

**Encrusting morphologies**, 201

**Endangered mutualisms**, 83–103

**Endangered Species Act**, 100

**Endoliths**, 197

**Endophyte-conferred resistance**, 329

**Endophyte-grass mutualism**, 329, 336

**Endophytes**  
community effects of, 328–31  
interaction webs with herbivores and plants, 326–28  
nonsystemic, 324, 330–31  
population dynamics of, 328–31  
synonymous with mutualists, 325  
systemic, 328–30

**Endophytic fungi**  
continuum of interactions with host plants, 319–36  
ecological consequences of, 324–26  
evolutionary origins of, 324–26  
mode of transmission, 332  
reproduction, 324  
seasonal accumulation of, 333–34  
spatial and genotypic changes in, 334–36

spatial patterns of infection, 333  
systemic vs localized infections, 323–24  
taxonomy and specificity, 323  
Endopolyploidy, 469  
Energy and organic carbon  
limitation of bacterioplankton  
growth efficiency, 519–24  
Energy intensiveness trends, 300–301  
Energy requirements in natural  
bacterial assemblages  
metabolite excretion, 525–26  
physiologic condition of cells, 526–29  
taxonomic composition, 529  
transport of nutrients, 524–25  
See also Maintenance energy  
Energy school of  
thermodynamics, 299–300  
Energy-spilling pathways, 507  
Energy utilization  
benefits from huddling, 153  
shifting up food chain, 129  
*Enteromorpha intestinalis*, 385  
Entropy trends, 296–300  
energy school of, 299–300  
information school of, 297–98  
Environmental conditions  
hypothesis of floral symmetry, 355  
during pollination process, 355  
Environmental policy dimensions, 223–24  
Enzymes  
digestive, 388  
Eocene, 197, 200  
“Eoembryophytic” phase, 266  
“Eotracheophytic” phase, 266  
Epibenthos  
preservable, 188  
*Epichloë*, 323–25, 328–29, 332  
*Epilobium angustifolium*, 364  
Equilibrium  
See Far-from-equilibrium  
systems  
Eriksson, M, 360  
Erosion associated with roads, 210, 217–19  
Estuaries, 409–12  
ET  
See Ecosystem management  
Eudicots, 589–93  
Euphylllophytes, 271, 572  
Euploids  
rarity of gametes, 481  
and triploid formation, 481–83  
European Land-Ocean Interaction  
Studies (ELOISE), 405–6  
Eusociality, 162  
Eutherian mammals, 11  
Eutracheophytes, 273–75  
Eutracheophytic phase, 266  
Eutrophication, 423  
Evapotranspiration (ET)  
reduced by clear-cutting, 449–50  
Evolution  
of helping behavior, 141–68  
influencing endophyte  
interactions, 331–36  
organismal, 293–314  
plant, 265–66  
See also Large-scale trends  
Evolutionary development gates  
(EDGs), 281  
Evolutionary modification, 301  
reciprocal, 355  
Evolutionary origins of  
endophytic fungi, 324–26  
Evolutionary progress, 313–14  
Evolutionary rate  
assuming constancy in, 10  
average, 15  
Evolutionary significance, 41  
Evolutionary theory, 23  
Evolutionary versatility, 301–2  
Evolving taxa  
dynamics of, 297–98  
Excess density compensation, 133  
Excretion of metabolites, 525–26  
Exopolymers  
bacterial, 526  
Exploratory mode vs skeptical, 311–13  
Extinctions  
See Extirpations  
Extirpations  
cascade of, 113  
consequences of, 126–30  
in historic Guam, 119–20  
in modern Guam, 120–26  
in prehistoric Guam, 119  
Extra-group courtship, 152

**F**

Fabaceae, 361  
Facilitation  
of alliance formation, 160–61  
parental, 153–54  
Faegri, K, 366–67  
Falk, DA, 98  
Far-from-equilibrium systems, 299  
Farnum, P, 438  
Faunal composition  
change in, 87  
diversity, 191  
in hyporeic zones, 59  
similarity, 50–52, 54

Federal forest management, 435, 457  
Feeding anther-pollen collection  
hypothesis of floral  
symmetry, 366–67  
Feeding patterns of herbivores, 383–85  
Feinsinger, P, 88, 103  
*Felis concolor*, 213, 223, 225  
*F. onca*, 222  
FEMAT assessment, 452, 456  
Fenster, CB, 365, 367  
Fermentation  
microbial, 387, 389  
Ferns, 573–75  
Fertility  
bottlenecks in, 467  
hybrid, 494–95  
seed, 489  
Fertilization  
for improving forest growth, 442–43  
predicting response to, 443  
for repairing forests, 435  
*Festuca arundinacea*, 326–27  
Finger, TE, 385  
Fingerprinting methods  
multilocus vs single-locus, 157  
Fire exclusion, 451  
Fisher test, 132  
Fishes  
bony, 5  
freshwater, 24–27  
haplochromine, 3  
marine herbivores, 388, 391–95  
mercury pollution of, 543–63  
teleost, 375  
Fitzpatrick, JW, 164  
Fixation time, 2  
Flies as pollinators, 101  
Floater males  
non-territorial, 144, 158  
Flocculation of colloidal materials  
effect on coastal zones, 409  
Floral phylogeny  
and molecular genetics, 352–53  
and planes of symmetry, 346–48  
Floral symmetry  
and activity patterns of the  
pollinators, 364–67  
and adaptive suites, 354  
complexity-constancy  
hypothesis, 363–64  
complexity-neuronal/behavioral  
sophistication hypothesis, 361–63  
dangerous lower margin  
hypothesis, 366–67  
defined, 346

development of, 352–53  
 environmental conditions  
     hypothesis, 355  
 feeding anther-pollen collection  
     hypothesis, 366–67  
 flower distinctiveness  
     hypothesis, 357–58  
 fluctuating asymmetry  
     hypothesis, 359–61  
 frequencies of different types,  
     351–52  
 hypotheses of, 354–67  
 inflorescence type-flower  
     orientation hypothesis, 364  
 and information processing by  
     the pollinators, 358–64  
 innate symmetry preference  
     hypothesis, 358–59  
 marginal flower-attraction  
     hypothesis, 358  
 marginal flower-landing  
     platform hypothesis, 358  
 and molecular genetics, 352–53  
 natural position hypothesis, 364  
 optical information hypothesis,  
     356  
 perception by the pollinators,  
     356–58  
 in plant-pollinator systems,  
     345–69  
 pollen position hypothesis,  
     364–65  
 precise steering-individual  
     flower hypothesis, 366  
 protection from rain hypothesis,  
     355  
 reward wastage hypothesis,  
     365–66  
 syndrome concept and, 354  
 terminology for, 348–51  
 unequal image projection  
     hypothesis, 356–57

Florin, R. 579  
 Flow dynamics, 66  
     ecological, 207  
 Flower distinctiveness hypothesis  
     of floral symmetry, 357–58  
 Flowering plants, 345–69  
     polyploidy in, 467–96  
 Flower orientation hypothesis of  
     floral symmetry, 364  
 Flower visitors  
     obligate, 84–85  
 Flow paths, 66  
 Fluctuating asymmetry hypothesis  
     of floral symmetry, 359–61  
 Flushing effects, 65, 68  
 Food intake rate, 390–91  
 Food selection of herbivores,  
     385–86  
 Food webs

changing over time, 126–28  
 connectance within, 85  
 Foraging theory, 381  
 Foraminifera  
     fusilinid, 196  
 Forest roads, 222  
 Forestry  
     diversity and habitat, 450–53  
     future of, 455–59  
     history of, 437–38  
     improving growth, 439–43  
     resistance to disturbances,  
         453–55  
     scientific basis of, 435–59  
     and soils, 444–48  
     and water, 448–50  
 Forest vertebrates of Guam,  
     119–30  
 Forgotten Pollinators Campaign,  
     100  
 Fossil species, 264  
 Foster, GS, 440  
 Founding population sizes, 18  
 Fragmentation  
     biological effects of, 86–88  
     related declines in pollination,  
         88  
 Frank, SA, 247  
 Free, JB, 358–59  
 Frequency-dependent selection, 16  
 Freshwater turtles, 29–45  
*Freycinetia arborea*, 99  
*Fritillaria lanceolata*, 486  
 Fritts, T, 124  
 Fuller, B, 455  
 Functional loci  
     See Loci  
 Fungal reproduction, 319–36  
 Fungi  
     endophytic, 319–36  
     outcrossing in, 6  
     pathogenic, 97  
 Funtowicz, SO, 459

**G**

*Galeopsis pubescens*, 472  
*G. speciosa*, 472  
 Galetto, MJ, 389  
*Gallinula chloropus*, 145  
 Gametes  
     See Unreduced gametes  
 Gametophytes  
     unreduced female, 474  
 Genealogical concordances, 23  
     across characters within a gene,  
         48  
     across multiple codistributed  
     species, 49–50  
 across multiple genes, 48–49  
 with biogeographic provinces  
     identified by independent  
     evidence, 50, 52  
 principles of, 25  
 Genealogy  
     molecular techniques in  
     resolving, 141  
 Gene flows  
     interdrainage, 41  
     long-term historical barriers to,  
         48  
 Genes  
     coadapted, 12  
     concordance across characters  
         within, 48  
     cycles of expansion and  
         contraction, 11  
     duplication, 6–7  
     See also Multiple genes  
 Genetic approach for improving  
     forest growth, 439–41  
 Genetic conflict, 233–55  
     cyto-nuclear, 242  
     defined, 235–36  
     maternal-paternal, 244  
     over sex determination, 242–44  
     parent-offspring, 243–44  
     sex-chromosome drive and  
         B-chromosome drive,  
         242–43  
 Genetic conflict systems, 247–54  
     cytoplasmic male sterility in  
         plants, 250–52  
     cytoplasmic sex-ratio distorters  
         in animals, 248–50  
     other systems, 252–54  
     sex-chromosome drive, 247–48  
 Genetic distance matrices  
     neighbor-joining and/or  
         phenetic clustering applied  
         to, 28  
 Genetic distances converted to  
     time intervals, 9  
 Genetic diversity, 457  
 Genetic drift, 86, 166  
     random, 11  
 Gene trees  
     intraspecific, 48  
     major phylogenetic branches in,  
         48  
     not matching species trees, 17  
 Genotype-phenotype maps, 302  
 Genotypic changes in endophytic  
     fungi, 334–36  
*Gentiana*, 358  
 Geological formations  
     degassing from, 546  
 Gibbons, 8  
 Gibert, J, 72  
*Gilia*, 477

*Ginkgo*, 580-81  
 Global cycles  
     of mercury, 544-46  
     of oceanic carbon, 423-26  
 Glucogenolysis, 3  
 Gluconeogenesis, 3  
 Glucose-6-phosphatase (*G6P*), 3  
 Glycosyltransferases, 8  
 Gnathostomes  
     gene group coding for, 4  
 Gnetales, 588  
     relationship to angiosperms, 581-86, 595  
 Goldman, JC, 518  
*Gonipora* sponges, 187  
 Good, R, 358  
*Gopherus polyphemus*, 46, 49  
 Gordon, JI, 383  
 Gordon, JC, 459  
*G6P*,  
     See Glucose-6-phosphatase  
 Grant, GE, 449  
 Grant, V, 477, 489, 493  
*Graptemys geographica*, 39, 49  
*G. pulchra*, 37, 39  
 Graves, JAM, 245  
 Grazing, 90  
 Green, DJ, 147  
 Greenwood, PH, 163, 166  
 Griffith, PC, 513  
 Griffiths, RP, 517  
 Groom, MJ, 87  
 Grooming  
     ostentatious, 161  
 Groundwater, 60  
     interacting with hyporheic zone, 61  
     interface with riverine environments, 60  
 Groups  
     reasons for joining, 144  
 Growth efficiency  
     bacterial (BGE), 503-34  
     defined, 505  
     and energy requirements, 524-29  
     metabolic excretion, 525-26  
     physiologic condition of cells, 526-29  
     taxonomic composition, 529  
     transport of nutrients, 524-25  
     uncoupled from growth rate, 516  
 Guam  
     biodiversity crisis in, 113-37  
     forest vertebrates of, 119-30  
     nonvertebrates in, 129-30  
     World War II destruction to, 120, 131  
 Gut passage rate, 381, 391

**H**

Habitat diversity along roadsides, 211  
 Habitats  
     conservation of, 95-96  
     disturbed, 125-26, 489  
     fragmentation in, 88, 215-16  
     and intensive forestry, 450-53  
     invasion of new, 195  
 Haig, D, 253  
 Haiman, JP, 150  
 Hamilton, WD, 245  
 Hamilton's rule, 147  
 Hansen, TA, 301  
 Haplochromine fishes, 2-3, 13  
*Haplochromis bloyeti*, 3  
*H. nubilis*, 3  
*H. xenognathus*, 3  
 Hare, H, 243  
 Harlan, JR, 475  
 Harper, KT, 358, 365  
 Hartley, IR, 142  
 Hatcher, BG, 384  
 Hay, ME, 396  
 HCC  
     See Hyporheic corridor concept  
 Heavy metals entering streams via roadsides, 220-21  
 Heikes, B, 521  
 Heinrich, B, 361  
 Helpers  
     casual vs regular, 143  
     experimenting with, 149, 152  
     improving chances of becoming breeders, 142  
     motivation of, 144-46  
     rearing collateral kin, 142  
 Helping behaviors  
     adaptive explanations for, 145, 147-62  
     in cooperatively breeding birds, 141-68  
     costs of, 144-45  
     for enhanced productivity, 147, 149-52  
     evidence for load-lightening, 151-52  
     and female heterogamy, 166  
     group membership not necessary for, 144  
     interests of males and female helpers in, 141, 165  
     and lifetime reproductive success, 164-65  
     sex-biased dispersal and, 149-50, 162-65  
 and suboptimal brood size, 166  
 uncertainty about adaptive significance, 167  
 and uncertainty over parentage, 165-66  
*Hemidactylus frenatus*, 114  
 Herbicides  
     entering soil via roadsides, 220  
     in the pollution crisis, 91-92, 97-98  
 Herbivore resistance, 326  
 Herbivores  
     defenses against, 383  
     interaction webs with endophytes, plants and, 326-28  
     marine fish, 388  
     vertebrate, 375-97  
 Hermaphrodites  
     outcrossing in, 87  
 Herrera, CM, 354  
 Heterogamy, 166  
 Heterospory, 286  
 Heterotrophic bacteria, 503-4  
 Heterotrophic components and respiration rate of ecosystem, 407  
 Heterozygosity, 216  
 Hexaploid formation, 486  
 Hg(II)  
     reduction of, 551-53, 556-57  
     See also Mercury  
*Hibiscus*, 350  
 Hickey, LJ, 588, 590  
 Hierarchical open-ended system (HOPE) strategy, 440  
 Higher ploidy formation  
     one-step, 473  
 High-yielding cultivars, 457  
 Hirschfeld, L, 8  
 Histocompatibility  
     See Major histocompatibility complex (*Mhc*)  
 Historical barriers to gene flow  
     long-term, 48  
 Hitchhiking, 244  
*HLA* complex  
     See Human leukocyte antigen  
 Hofmann, RR, 383  
 Hollibaugh, JT, 424, 426  
 Holm, E, 366  
*Holobates*, 8  
 Homoplaid crosses, 488  
*Homo sapiens sapiens*, 8, 14, 17-18  
 Honeybees  
     Africanized, 88  
     decline of, 83  
 HOPE strategy  
     See Hierarchical open-ended system (HOPE) strategy

Horn, MH, 386, 388  
 Hornwarts, 269  
 Horridge, GA, 359  
 Host plants, 319-36  
 infected and uninfected coexisting, 334  
 Howard, HW, 235  
 Human A antigen, 8  
 Human antiserum  
 agglutinating chimpanzee erythrocytes, 8  
 Human leukocyte antigen (*HLA* complex), 11  
 Hummingbirds  
 understory, 89  
 Hunter, ML Jr, 457  
 Hurst, LD, 247, 252, 254  
 Huxley, JS, 294  
 Hybridization  
 of autopolyploids, 473, 493  
 of different cytotypes, 473-74  
 estimated frequency of, 493  
 interspecific, 467  
 introgressive, 25, 37  
 Hybrid vs non-hybrid systems  
 fertility in, 494-95  
 spontaneous polyploidy in, 487-89  
 Hydrologic exchange patterns, 71-72  
 in forests, 448-50  
 Hydrologic models  
 expanding to three-dimensions, 68-69  
 Hydrologic retention, 66  
 Hydrolysis of polymers, 525  
 Hyper-euploids, 487  
 Hypo-euploids, 487  
 Hyporeheic corridor concept  
 (HCC), 59, 71-72  
 supporting predictions of, 73  
 Hyporeheic zone processes, 63-74  
 catchment-scale, 71-74  
 reach-scale, 66-71  
 sediment-scale, 63-65  
 Hyporeheic zones (HZs), 59-75  
 altering composition of, 73  
 defined, 59  
 faunal composition, 59  
 functional significance of, 60-63  
 hydrological compartments  
 interacting with, 61, 73  
 invertebrate distribution within, 70  
 refuge to surface invertebrates, 68  
 scale context for, 61, 63  
 Hypothesis-generation mode, 295-96, 312-13  
 Hypothesis-testing mode, 296, 312-13  
 HZs  
 See Hyporeheic zones

**I**

IBP  
 See International Biological Program

Illiis, AW, 383

Immune response  
 anticipatory form of, 4  
 Improving forest growth, 439-43  
 fertilization, 442-43  
 genetics, 439-41  
 treatment combinations, 443  
 vegetation management, 441-42

Inbreeding depression, 86, 154

Incest avoidance, 141, 153-54, 157-58

Incorporation rates, 14  
 for the human *Mhc* loci, 14-15

Indels  
 two-codon, 5

Inducing polyploid formation, 469-74

Infections  
 spatial patterns of, 333  
 systemic vs localized, 323-24

Inflorescence type-flower  
 orientation hypothesis of floral symmetry, 364

Information processing by pollinators  
 during pollination process, 358-64

Information school of thermodynamics, 297-98

Inheritance  
 territorial, 153, 159, 165

Innate symmetry preference  
 hypothesis of floral symmetry, 358-59

Insects  
 conservation of, 103  
 roadkilled, 212  
 social, 168

Insertion elements in introns  
 dateable, 12

In situ measurements of bacterial growth efficiency (BGE), 508-10, 512-13, 515

Integration  
 approaches to measuring degree of, 302

Intensive forestry  
 history of, 437-38

Interaction webs, 86, 102  
 among endophytes, plants and herbivores, 326-28

Interdrainage gene flows  
 restrictions on contemporary, 41

Interface between river and groundwater environments, 60

Intergenic segments  
 mutations in, 2  
 "Intergradation" among polyploids, 473

Intermodal Surface Transportation Efficiency Act (ISTEA), 224

International Biological Program (IBP), 451  
 studies funded by, 456

International Conference on Forest Vegetation Management, 442

International Union for Conservation of Nature and Natural Resources (IUCN), 100

Internet web sites, 100, 468

Intersections  
 time line, 9

Interspecific hybridization, 467

Interstitial flow pathways, 63  
 clogging, 63-64

Intraspecific systematics, 23

Introduced species  
 degradation of ecosystems by, 113-37  
 evaluation of impacts, 114-19  
 predators, 113

Introns, 3, 10  
 with dateable insertion elements, 12  
 large sequence differences in, 12  
 mutations in, 2

Ioerger, TR, 5

*Ipomopsis aggregata*, 87-88

Irruptions, 121-26  
 consequences of, 126-30

Isovalerate, 393-94

ISTEA  
 See Intermodal Surface Transportation Efficiency Act (ISTEA)

Iteroparous plants, 102

IUCN  
 See International Union for Conservation of Nature and Natural Resources

**J**

Jablonski, D, 306  
 Jackson, RC, 471

Jaenike, J, 248  
 Jain, SK, 89  
 James, W, 294  
 Jamieson, IG, 144  
 Jawed vertebrates, 1  
 Johnson, SD, 87  
 Joint dispersal, 164  
 Jones, JA, 449  
 Juchault, P, 249–50  
 Jungermanniales, 268–69  
 Jurassic, 583

**K**

Karr, JR, 444  
 Kauffman, SA, 303  
 Kelley, PH, 301  
 Kempe, S, 426  
 Kendall, J, 477  
 Kenrick, P, 268, 281–82, 285, 570, 573  
 Kevan, PG, 90, 103  
 Kihara, H, 470  
 Kinetic hindrance, 554  
 King, GM, 510  
*Kinosternon baurii*, 37, 52  
*K. subrubrum*, 32, 34, 36–37, 49–50, 52–54  
 Kinship  
 collateral  
 See Cooperative polyandry  
 Kirchman, DL, 520  
 Klein, J, 5  
 Koenig, WD, 144, 162, 164–66  
 Kohanzadeh, Y, 356  
 Kolmogorov-Smirnov  
 One-Sample test, 483  
 Kostoff, D, 477  
 Kroer, N, 518  
 Kwak, MM, 96  
 Kypophidae, 395

**L**

LaBarbera, M, 306  
 Lamarck, JBPAM, 294  
 Lammers, TG, 99  
 Land biotas  
 primary radiation of, 263–87  
 Land-Ocean Interactions in the  
 Coastal Zone (LOICZ), 405–6, 421, 426  
 Land plant biomechanics, 271–75  
 bryophytes, 271–72  
 eutracheophytes, 273–75  
 lignophytes, 275  
 “protracheophytes,” 272–73  
 rhyniopsids, 272–73  
 Land plant phylogeny, 266–71  
 euphylophytes, 271  
 hornworts, 269  
 land plants, 267–68  
 liverworts, 268–69  
 lycophytes, 270  
 mosses, 269  
 vascular plants, 270  
 Land plant physiology  
 and biomechanics, 271–75  
 revolutionary reinterpretations  
 of, 263  
 Landscape  
 changing patterns of, 221–22  
 low-competition, 263  
 Landslides, 219  
 Landsteiner, K, 5  
 Large-scale trends  
 adaptedness, 304–6  
 classifying, 309–10  
 common themes and  
 connections, 306–7  
 complementary modes of  
 investigation, 311–13  
 complexity, 306  
 developmental depth, 302–4  
 energy intensiveness, 300–1  
 entropy, 296–300  
 evolutionary versatility, 301–2  
 in organismal evolution,  
 293–314  
 passive vs driven, 307–9  
 size, 306  
 structural depth, 304  
 types of, 307–11  
*Lavandula latifolia*, 85  
 Laverty, TM, 364, 368  
 Lawlor, DA, 5  
 Lee, H, 356  
 Legrand, JJ, 249  
 Lemmings, 252–53  
*Lepidodactylus lugubris*, 114  
 Lepidoptera, 101  
*Lepomis microlophus*, 52  
*L. punctatus*, 25–26  
 Leprik, EE, 348–49, 358, 365  
*Leptonycterus curacaoe*, 100  
*Lesquerella fendleri*, 87  
 Lessells, CM, 164  
 Leuchtmann, A, 334  
 Lewis, AC, 362  
 Lewis, D, 235, 250, 471, 476  
 Lignophytes, 275  
 conifers, 579–80  
 cycads, 578–79  
*Ginkgos*, 581  
*Gnetales*, 581–86  
 Ligon, JD, 159  
 Lin, B-Y, 480  
 Lineages  
 allelic, 9–16

Lines-of-descent theory, 9  
 “Live hypotheses,” 294–95  
 Liverworts, 569  
 dominance during  
 “eombryophytic” phase,  
 266, 282  
 marchantialean, 268  
 Load-lightening hypotheses,  
 151–52  
 by only one gender, 151  
 Lobel, PS, 386–87  
 Localized infections, 323–24  
 Loche, K, 518  
 Loci  
*DRB1, DQA1, DQB1, DBP1*, 12  
 in fingerprinting methods, 157  
*Mhc* class I and class II, 4–5,  
 11–12  
 monomorphic, 4  
 oligomorphic, 4  
 polymorphic, highly, 4  
 self-incompatibility, 6–8  
 Loconte, H, 588  
*Lolium perenne*, 326–27  
 Longitudinal gradients, 67  
 Long-term historical barriers to  
 gene flow, 48  
 Lord, JM, 97  
 Low-competition landscape,  
 263  
 Lucas, M, 517  
*Lycopersicon esculentum*,  
 473  
*L. pimpinellifolium*, 473  
 Lycophytes, 270  
*Lycopodium*, 570, 572  
 Lyons, J, 459  
*Lythrum salicaria*, 210

**M**

MacArthur, RH, 133  
 Mackenzie, FT, 425  
*Macroclemys temminckii*, 41, 49  
 Macrophyte-based ecosystems,  
 412–14  
 Macrophyte-dominated  
 ecosystems, 412  
 Magnoliidae, 586, 588–89  
 Maintaining populations and  
 species during pollination  
 crisis, 97  
 Maintenance energy in: bacterial  
 cultures with defined media,  
 506–7  
 Major histocompatibility complex  
 (*Mhc*), 4–5, 11–12  
 gene fragments in, 4  
 polymorphism maintained by  
 overdominant selection, 4

pseudogenes in, 4  
 serologically indistinguishable  
 allomorphs of, 4  
 truncated genes in, 4

Malpighiaceae, 90  
*Malurus cyaneus*, 152, 158  
*M. splendens*, 149

Mammals  
 eutherian, 11  
 marsupial, 11  
 primate, 8, 11

Management efforts  
 species-focused, 54

Mangroves, 414-17  
 ecosystem function of, 414-17

*Manihot erubescens*, 473  
*M. glaziovii*, 473

Manning's equation, 69

Mannitol, 385, 389

Mann-Whitney U test, 475, 483

*Manorina melanophrys*, 159

Margin flower-attraction  
 hypothesis of floral  
 symmetry, 358

Marginal flower-landing platform  
 hypothesis of floral  
 symmetry, 358

Marine faunas  
 Cambrian explosion of, 263

Marine vertebrate herbivores  
 environments of, 375-97  
 studies of, 376-77

Marks, GE, 476

Marnane, M, 391

Marsupials, 11

Maternal-paternal conflict, 244

Mating  
 access to, 154-59  
 bizarre diversity of, 168  
 future access to, 158-59  
 within the group, 154, 157-58  
 outside the group, 158

Mating systems of plants, 88

Maturation  
 prolonged, 160-62

Mäule reaction, 582-83

Mauder, M, 98

Maurice, S, 251

Maxima  
 behavior of, 310  
 rising, 295

Maximum likelihood applied to  
 presence-absence  
 restriction-site matrices, 28

Maxwell, JR, 52

Mayer, AM, 553

Mayer, WE, 5

Maynard Smith, J, 294, 304,  
 309-10

McKeand, SE, 443

McKinney, ML, 306

McVean, G, 252, 254

Mechanisms of polyploid  
 formation, 469-74  
 autoploidy and  
 allopolyploidy, 470-71  
 second-generation, 474

Medial zygomorphy, 351, 354-55,  
 368

*Medicago sativa*, 476

*Megachile rotundata*, 99

Megafossil record, 268-69

MeHg  
 accumulation of, 562

Meili, M, 550

Meiofauna, 64

Meiotic aberrations, 474

Meiotic nuclear restitution,  
 470

*Melanoplus femur-rubrum*,  
 329

*Melipona*, 94

Melittophily, 354

MerA reductase, 553

MerB enzyme, 554

Mercury  
 bioaccumulation of, 543-63  
 biomagnification in the food  
 chain, 560-62  
 chemistry in anoxic waters and  
 sediment, 555-59  
 chemistry in surface waters,  
 546-55  
 divalent, 549-50  
 global cycle of, 544-46  
 microbial uptake of, 559-62  
 organometallic species of, 551  
 returned from atmosphere, 545  
 solubility of, 555-56

*Merops apiaster*, 152

Mesozoic, 179-81, 197, 200-1,  
 269, 578, 581

Mesozoic Marine Revolution  
 (MMR), 197

Metabolism within coastal zones,  
 405-27

Metabolic excretion and growth  
 efficiency, 525-26

Metacinnabar, 555

Metapopulation creation, 216

Metazoan, 185-87

Metazoan marine animals  
 Cambrian radiation of, 283, 287

Methylation  
 of mercury, 557-59  
 by sulfate-reducing bacteria,  
 543, 559

Methylmercury sources in surface  
 waters, 554-55

Metzgeriales, 268-69

Meybeck, M, 408

Meyen, SV, 581

*Mhc*,  
 See Major histocompatibility  
 complex

Microbenthos, 194

Microbial activity  
 within sediment-scale  
 processes, 63-64

Microbial assemblages  
 oligotrophic, 515

Microbialites, 185  
 reefal, 190

Microbial symbionts, 388-89

Microbial uptake of mercury,  
 559-62

Middleboe, M, 516, 525

Miller, CR Jr, 8

Miller, DJ, 301

Miliman, JD, 424

*Mimosa pudica*, 94

*Minimus lewisi*, 469

*M. nelsoni*, 469

Mineral nutrient fertilization along  
 roadsides, 210

Mineral nutrient limitation of  
 bacterioplankton growth  
 efficiency, 518

Mineral solubility product,  
 182

Minima  
 behavior of, 311  
 stable, 295

Mitigation, 224-26

Mitochondrial DNA  
 polymorphism in, 3

Mitochondrial Eve frenzy, 17

Mitochondrial variation, 39

MMR  
 See Mesozoic Marine  
 Revolution

Mocquard, JP, 249-50

Models for sex determination,  
 244-46  
 accumulation-attrition, 245  
 population structure and  
 inbreeding, 245  
 transient covariance of fitness  
 and sex, 244-45  
 variable fitness of males and  
 females, 245-46

Modern reef ecosystems, 194-201  
 diversity of, 182-83  
 photosymbiosis and, 195-97  
 and rise of predation and  
 bioerosion, 197-201

Molecular genetics  
 and development of floral  
 symmetry, 352-53  
 disagreement among data sets,  
 568

Molecular phylogeny, 567  
 constraints on, 279-80

Molecular systematics  
advantages over morphological, 568

Molecular trans-species  
polymorphism (TSP), 1–18

Moles, 254

Møller, AP, 359–60

Monkeys  
New World, 8  
Old World, 8

Monocots, 593–94

Monomorphic loci, 4, 10

*Moraea*, 351

Morita, RY, 527

Morphological phase of plant evolution, 266

Morphological phylogeny, 567  
constraints on, 280–82

Mosses, 269, 569

MPBS  
See Multiple population breeding system

mtDNA variation  
clades and, 52  
configuration of intraspecific subdivisions, 23  
geographical patterns in, 23–24  
intraspecific phylogeographic partitioning in, 27  
paucity of, 41

Mucopolysaccharides  
extracellular production of, 525

*Mugil cephalus*, 387

Multiflagellate sperm, 572

Multifurcation  
speciation by, 18

Multilayered epithelial growth, 201

Multiple codistributed species  
concordance of genealogical partitions across, 49–50

Multiple genes  
concordance of genealogical partitions across, 48–49

Multiple population breeding system (MPBS), 440

Multiple Use Sustained Yield Act of 1960, 444

Multirotation predictions, 447

Mumme, RL, 144

Münzing, A, 472, 478

Murcia, C, 88

*Musca domestica*, 239, 241, 245

*Mus domesticus*, 5, 123, 237

*M. musculus*, 247

Museum species, 99

Mutations  
advantageous, 2  
deleterious, 2  
rate of, 1–2  
genome region of, 2–3

neutral, 2  
newly-arisen, 1  
rapid intraspecific accumulation of, 5  
rate of, 467

Mutualism, 85  
causes of, 331  
endophyte-grass, 329  
and parental facilitation, 153  
in plants, 319–36  
See also Endangered mutualisms

*Myopsis schisticolor*, 252

*Myzomela rubratra*, 130

**N**

*N*-acetylgalactosaminyl transferase, 8

*Nactus pelagicus*, 115, 123

Nakamura, M, 153

*Nasonia vitripennis*, 239, 241, 243, 248–49

National Forest Management Act of 1976 (NFMA), 452

National Forest System, 448

Native pollinators, 89–90

Natural bacterial assemblages, 524–29

Natural position hypothesis of floral symmetry, 364

Navashin, M, 470

“Nectar cover,” 355

Neighbor-joining applied to genetic distance matrices, 28

Nelson, SG, 387

Neo-Darwinians, 280

Neoproterozoic, 185

*Neotryphodon*, 323–25, 327–30, 332, 334

**NEP**  
See Net ecosystem production

Net autotrophic systems, 407, 423

Net ecosystem production (NEP)  
defined, 407  
estimating, 414, 416

Net heterotrophic systems, 424

Networks of roads, 221–23  
new roads and changing landscape pattern, 221–22  
road density, 222–23

Neuronal detectors, 363

Neutral trans-species polymorphism (TSP), 2–4  
persistence time of, 4

Newell, ND, 306

Newell, RC, 517

NFMA  
See National Forest Management Act of 1976

*Nicotiana alata*, 7

*N. paniculata*, 474

*N. rustica*, 474

Nitrification, 63

Nixon, KC, 584, 588

Nixon, SW, 423, 425

*Nomia*, 98

Nondescendant kin  
deferred production of, 150–52  
enhanced production of, 147, 149–52

Non-reduction in polyploid formation, 470

Nonstemonic endophytes, 324, 330–31

*Notothylas*, 269

Novelty radiations, 263

Nuclear DNA  
polymorphism in, 3

Nucleotide sequence divergence estimated, 28

Nuncio, J, 521

Nur, U, 241

Nutrient limitation of bacterioplankton growth efficiency, 518–19

Nutrients  
assimilation of, 389–90  
transport of, 524–25

Nutritional ecology of vertebrate herbivores, 375–97

**O**

Obligate flower visitors, 84

Oceanic carbon cycle  
global, 423–26

Oceans  
ultraoligotrophic, 513

Odacidae, 395

*Odax cyanomelas*, 389

*Odocoileus virginianus clavium*, 213

*Oenothera*, 469, 481

*O. deltoides*, 86

*O. organensis*, 6–7

Oligosaccharide chain residues producing human A antigen from, 8

Olesen, JM, 89

Oligo-Miocene, 197

Oligomorphic loci, 4

Oligotrophic microbial assemblages, 503–34

**OM**  
See Organic matter

Ono, T, 470

Ophioglossales, 574

*Ophrys*, 360

Opportunism, 85

Optical information hypothesis of floral symmetry, 356

Optimal foraging, 381

Orangutans, 8

Ordovician, 265–66, 268

Organic carbon limitation of bacterioplankton growth efficiency, 508–9, 519–24

Organic matter (OM) sediments, 65 transformation of, 503

Organic substrates sources and quality of, 521–24

Organometallic species of mercury, 551

Orientation of symmetry planes, 349–50

Origin of life, 299

Ornithophily, 354

Orthologs, 11

*Osmia cornifrons*, 99

*O. pumila*, 90, 95

Oumstergen, G., 236

Outcrossing taxa, 467

Overdominant selection, 16

Overpass designs, 225

Oversplit at species level, 39

Oxic waters chemical speciation in, 546, 549–51

Oxidation of elemental mercury, 554 of organic matter, 521–23

**P**

Paleobotany recent advances, 264–65

Paleoecology, 275–78

Paleoproterozoic, 185

Paleozoic, 185–86, 197, 200–1, 269–70, 279, 573, 575, 578–79, 581

*Pan troglodytes*, 8

Papaveraceae, 7

*Papaver rhoes*, 7

*Parablennius sanguinolentus*, 386

Parafluvial zone interacting with hyporheic zone, 61

Parentage uncertainty over, 165–66

Parental care acquisition of skills for, 161–62 costs of providing care to young, 145 evidence for load-lightening, 151–52 facilitation, 153–54

Parental effect in sex determination, 241

Parental sex-ratio genes in sex determination, 239

Parent-offspring conflict, 243–44

Parkin, J., 581

Parsimony applied to presence-absence restriction-site matrices, 28 networks of, 32

Particle size in sediment-scale processes, 63

Particulate organic carbon (POC) monitoring changes in, 509–10

*Passer domesticus*, 213

Passive large-scale trends, 307–10

Paternity analysis, 154, 157 molecular methods of, 157

Pathways of polyploid formation, 471–74

allopolyploidy, via hybridization of autopolyploids, 473

allopolyploidy, via hybridization of different cytotypes, 473–74

allo tetraploid, one-step, 473

allo tetraploid, triploid-bridge, 472–73

autotetraploid, one-step, 472

autotetraploid, triploid-bridge, 472

higher ploidy, one-step, 473

Patterns in bacterial growth efficiency (BGE), 510–15 ecological consequences of, 529–33

in situ measurements, 510, 512–13, 515

temporal variation in, 515

uptake and incorporation of single substrates, 510

Pavlik, B.M., 86

Payne, A.L., 387

Peptide-binding region (PBR) sites, 5, 12

nonsynonymous, 15

synonymous, 17

Peptides proteins capable of binding, 4

Perception by pollinators during pollination process, 356–58

Percy, D.M., 87

Permian, 187–89, 196, 266, 269, 578, 581, 586

Permian-Mesozoic, 576

*Perichirus atelus*, 130

Pesticides and the pollution crisis, 91, 97–98

post-war use in Guam, 120, 130 regulating, 98

Petit, S., 95

Petrini, O., 323–24

*Petunia inflata*, 7

*Phalaris coerulescens*, 7

Phanerozoic, 188, 196, 200, 264

*Phaseolus vulgaris*, 251

Phenetic clustering applied to genetic distance matrices, 28

Phenotypic diversity, 263

Phenyl-thiocarbamide (PTC) ability to taste, 8

Philpott, W.R., 592

Philopatric birds, 142, 153

Phosphatase activity alkaline, 63

Photochemical oxidation of organic matter, 521–23

Photodegradation, 554

Photoinhibition, 385

Photosymbiosis acquired by corals, 179 loss of, 196 and modern reef ecosystems, 195–97 reefs not using, 185 relationships, 195

Photosynthesis and daily feeding rates, 385–86

Phylogenetic analysis complicated by trans-species polymorphism, 17

Phylogenetic tree, 9 branch-time line intersections within, 9 not matching species trees, 17

UPGMA (unweighted pair-group method with arithmetic mean), 10–11

Phylogeny advances in, 567–95 floral, 346–48 molecular, 279–80 morphological, 280–82 reconstruction of, 278–82 star-shaped, 18 strengths of, 278–79 of vascular plants, 567–95

Phylogeographic separations, 52–54

Phylogeographic structure limited, 46, 48 significant, 46

Phylogeography and genealogical concordance, 46–52 hypotheses of, 46–52 outcomes by species, 28–46 reflecting long-term historical barriers to gene flow, 48

*Physalis crassiflora*, 14

Physicochemical controls on distribution of reefs, 184

Physiologic condition of cells and growth efficiency, 526-29

*Phyteuma nigrum*, 96

Phytoplankton  
coastal, 422

*Pieris rapae*, 362

Pimm, SL, 102, 132

*Pinus radiata*, 444

*Piroconites*, 583

*Pithecellobium elegans*, 88

Planes of symmetry and floral phylogeny, 346-48

Plankton  
calcareous, 181  
respiration attributable to, 410, 412

Planktonic bacteria, 503, 508, 560

*Plantago lanceolata*, 251

Plant assemblages and diet quality for herbivores, 382-85

Plant biomass  
global, 376

Plant evolution, 265-66  
Anatomical phase, 265-66  
Behavioral phase, 266  
Biochemical phase, 265  
Morphological phase, 266

Plant fecundity  
reduction in, 102

Plant hormones, synthetic, 99-100

Plant physiology  
revolutionary reinterpretations of, 263

Plant-pollinator systems  
role of floral symmetry in, 345-69

Plants  
flowering, 345-69, 467-96  
iteroparous, 102  
land, 271-75  
mating systems of, 88  
population dynamics of, 101-2  
vascular, 270, 567-95

Platyrhynchus, 11-12, 17

Pleistocene, 53, 183, 201

Pliocene, 53-54

Plochmann, R, 437

Poaceae, 7

POC  
See Particulate organic carbon

Poindexter, JS, 516

Pollen delivery declines, 87

Pollen limitation, 86-87

Pollen position hypothesis of floral symmetry, 364-65

Pollination biology  
role of floral symmetry in, 345-69

Pollination crisis, 83, 86-95, 102  
biological effects of  
fragmentation, 86-88

domestication of wild bees and other pollinators, 99-100  
effects of agricultural practices on wild pollinators, 89-90  
grazing, 90  
herbicides, 91-92, 97-98  
honeybee declines, 92-93  
legal protection, 100  
maintaining populations and species during, 97  
non-native pollinators, 93-95  
pesticides, 91, 97-98  
and plant population dynamics, 101-2  
public education, 100  
reintroductions of pollinators, 98-99  
removal of alien pollinators, 99  
studies of pollination in fragments, 88-89

Pollination process  
activity patterns of pollinators during, 364-67  
environmental conditions during, 355  
information processing by pollinators during, 358-64  
perception by pollinators during, 356-58  
shift from wind-based to insect-based, 591

Pollination services, 87  
native birds, 129

Pollination systems  
conserving, 83-103  
disruptions to, 90  
nature of, 84-86

Pollinators  
by bees, 354  
by birds, 354  
effects of agricultural practices on, 89-90  
exotic, 97  
by hand, 97  
hymenopteran, 101  
introduced, 99  
multiple, 98  
native, 89-90  
specialist, 97

See also Animal pollinators; Wild pollinators

Pollutants  
anthropogenic, 73

Polunin, NVC, 384

Polyandry  
cooperative, 142-44

*Polycladis nigra*, 244

Polymers  
hydrolysis of, 525

Polymerism  
and allozyme heterozygosity, 88

ancestral, 2, 12, 17  
cause of, 5  
concept of, 9-10  
defined, 9  
in DNA, 3  
intraspecific, 9  
in the *Mhc* system, 16  
from road barriers, 216  
shared, 2  
in the *SI* system, 16  
See also Trans-species polymorphism (TSP)

Polyplaid formation  
in flowering plants, 467-96  
mechanisms of, 469-74  
pathways of, 471-74  
spontaneous, 487-89  
and triploids, 478-87  
and unreduced gametes, 474-78

*Polypora* sponges, 187

Polyspermy, 470

Polysulfide complexes  
putative, 559

Pomiankowski, A, 247

*Pongo pygmaeus*, 8

Popper, KR, 312

Population dynamics  
of endophytes, 328-31  
of plants, 101-2

Population structure and inbreeding  
model for sex determination, 245

*Populus tremula*, 471, 481

*Porphyra perforata*, 386

*Porphyrio porphyrio*, 157

Pors, L, 95

*Posidonia oceanica*, 413

Powell, AH, 88

Powell, GVN, 88

Precise steering-individual flower hypothesis of floral symmetry, 366

Predators  
generalist, 132  
as introduced species, 113  
of reefs, 179

Presence-absence restriction-site matrices  
parsimony and/or maximum likelihood, applied to, 28

Pressure effect on  
bacterioplankton growth efficiency, 517-18

Primary terrestrial radiation  
of land biotas, 263-87  
phylogeny of, 263-87

Primates, 8, 11, 15

*Primula floribunda*, 469

*P. kewensis*, 469

*P. sieboldii*, 93

*P. verticillata*, 469  
 Prisoner's dilemma, 160  
 Productivity  
     deferred, 150-52  
     enhanced by helping behaviors, 147, 149-52  
 "Progymnosperms," 282  
 Propagation  
     clonal, 102  
 Prosimians, 11  
 Protection from rain hypothesis of  
     floral symmetry, 355  
 Proterozoic, 179, 185  
 "Protracheophytes," 272-73  
*Prunella modularis*, 141  
*Psaltriparus minimus*, 158-59  
 Psilotaceae, 570, 574  
*Psophia leucoptera*, 143  
 Pteridophytes, 569  
*Pteropus mariannus*, 114  
*P. tokudae*, 130  
 Pyke, GH, 94  
*Pyrus*, 476

**Q**

Quaternary, 48

**R**

Rabouille, C, 424, 426  
 Radiations  
     novelty, 263  
     primary terrestrial, 263-87  
 Radiotelemetric studies, 153  
 Raff, RA, 396  
 Rain protection hypothesis of  
     floral symmetry, 355  
*Rallus owstoni*, 121  
*Rana temporaria*, 216  
 Ratios between sexes, 233-55  
*Rattus norvegicus*, 5  
 Ravel, C, 335  
 Ravetz, JR, 459  
 Reach-scale processes, 66-71  
     assessing relative importance of variables in, 68-69  
     experimental approaches involving, 70-71  
     flow paths, 66  
     hydrologic retention, 66  
     involving surface stream biota, 67-68  
     longitudinal gradients in, 67  
 Real, LA, 362  
 Receptaculitids, 191  
 Recolonization, 71  
 Recombination  
     increase of frequency in, 14

Reduction of Hg(II), 551-53,  
     556-57  
     abiotic, 557  
 Reef bioerosion  
     rise in, 197-201  
 Reef-building organisms  
     changing trophic demands of, 179-201  
 Reef carbonate  
     global production of, 420  
 Reef communities  
     defined, 183  
 Reef ecosystems  
     complexity of ancient, 184-88  
     origins of modern, 194-201  
 Reefs  
     defined, 181-82  
     distribution of, 184  
     diversity of modern, 182-83  
     ecological evolution of, 179-201  
 Regulation of bacterioplankton growth efficiency, 517-24  
     effect of temperature, salinity, pressure, 517-18  
     energy and organic carbon limitation, 519-24  
     nutrient limitation, 518-19  
 Relatedness  
     assymetry in, 165  
 Remineralization, 426  
 Remington, CL, 27, 52  
*Renalcis*, 194  
 Rent payment  
     allowing access to mates, 154  
     allowing access to other benefits, 152-54  
     and territorial inheritance, 153  
 Reproduction  
     of endophytic fungi, 324  
 Reproductive bribing, 157  
 Reproductive sharing, 154  
 Reproductive success  
     alliances improving, 160-61  
     and helping behavior, 164-65  
 Resistance  
     to disturbances, 453-55  
     endophyte-conferred, 329  
     herbivore, 326  
 Resource concentration hypothesis, 454  
 Restriction-site matrices parsimony and/or maximum likelihood applied to, 28  
 Retention  
     hydrologic, 66  
 Reward wastage hypothesis of floral symmetry, 365-66  
 Reyer, H-U, 147  
*Rhacophyton*, 277, 573  
*Rhynia gwynne-vaughanii*, 276

Rhyniophytic phase, 265-66  
 Rhyniopsids, 272-73  
 Ricker, WE, 512  
 Riedl, R, 302-3  
 Rigaud, T, 250  
 Riparian zone interacting with hyporheic zone, 61  
 Rising maxima, 295  
 Riska, B, 302  
 River beds  
     porosity of, 59  
     topography of, 59  
 Rivers  
     input from, 408-9  
     interface with groundwater environments, 60

RNA  
     messenger, 7  
     ribosomal, 7  
 RNases, 7  
 Road avoidance, 207, 214-15  
 Road density, 222-23  
 Road-effect zone, 226  
 Roadkilled animals, 212-14  
 Roads  
     animals and movement patterns adjacent to, 211-12  
     and chemical transport, 219-21  
     effects on populations, 212-16  
     networks of, 221-23  
     plants and vegetation adjacent to, 210-11  
     and sediment yield, 218-19  
     statistics about, 208, 226  
     and their ecological effects, 207-26  
     water runoff from, 216-18  
     See also Transportation policy and planning

Road salt deterrence, 215  
 Roadsides  
     high plant species richness along, 210  
     mineral nutrient fertilization along, 210

Robbins, CT, 383  
 Robertson, AW, 365  
 Robinson, JD, 516  
 Roland, F, 513, 515, 517  
 Rose, CL, 442  
 Rothman, KJ, 457  
 Rothwell, GW, 573, 575-76, 579, 584

**S**

Sabapathy, U, 388  
 Sabine, CL, 424  
 Saikkonen, K, 335

Salinity effect on bacterioplankton growth efficiency, 517–18  
*Salix*, 90  
 Saltation model, 278  
*Salvia*, 87  
 Satina, S., 482  
 Savidge, JA, 121  
 SCFAs  
 See Short-chain fatty acids  
 Schardt, CL, 332  
 Schmitt, J., 87  
 Schwaerter, S., 515  
 Schweitzer, B., 516  
*Sciara coprophila*, 253  
 Scrophulariaceae, 361  
 Seasonal accumulation of endophytic fungi, 333–34  
 Seawater temperature, 184  
 Sediment-scale processes, 63–65  
 extrapolating relationships to reach scale, 65  
 flushing flow, 65  
 interstitial fauna, 64–65  
 interstitial flow pathways, 63  
 microbial activity within, 63–64  
 particle size, 63  
 Sediment transport  
 effect of forest management on, 449  
 effect of human activities on, 74  
 Sediment yield from roads, 218–19  
 Seed dispersal services of native birds, 129  
 by vehicles, 210  
 Seed fertility, 489  
 Seed plants  
 conifers, 579–80  
 cycads, 578–79  
*Ginkgos*, 581  
*Gnetales*, 581–86  
 Seeto, GS, 389  
 Selden, P., 265  
 Selection  
 agent of, 16  
 frequency-dependent, 16  
 overdominant, 16  
 Self-incompatibility (*SI*) systems, 6–8  
 and breakdown in polyploid formation, 476  
 gametophytic *SI*, 6–7  
 polymorphism maintained by frequency-dependent selection, 16  
 sporophytic *SI*, 6  
 Selfing taxa, 467, 493  
*Senecio cambrensis*, 489, 494  
*S. squalidus*, 489, 494  
*S. vulgaris*, 489, 494  
 Sentinel duty coordinated between adults and helpers, 149–50  
 Sequence comparisons, 11  
 Sequence data  
 DNA from extant relatives, 263  
 Sequence differences in introns, 12  
 Sequence divergence  
 estimated, 28, 53  
 Serbet, R., 579, 584  
*Sericornis frontalis*, 143  
 Sessile reef organisms, 181  
 Sex-bias in helping behaviors, 149–50, 162–65  
 Sex chromosome drive, 233, 247–48  
 and B-chromosome drive conflict, 242–43  
 Sex determination, 233–55  
 alternative models for, 244–46  
 diverse mechanisms for, 233–34  
 genetic conflict over, 242–44  
 history, 236–37  
 locked in, 246–47  
 parental effect, 241  
 parental sex-ratio genes, 239  
 system for, 237–42  
 zygotic, 241–42  
 Sex-ratio distorters  
 cytoplasmic, 248–50  
 Sex ratios, 233–55  
 Seymour, R., 457  
 Shainsky, LJ, 442  
 Shared polymorphism, 2  
 Sharp, DM, 453  
 Sheerin, A., 277  
 Short-chain fatty acids (SCFAs), 391, 393  
*SI*,  
 See Self-incompatibility (*SI*) systems  
 Siamang, 8  
*Siganus canaliculatus*, 388  
 Signal-transduction pathways, 7  
*Silene alba*, 248  
 Silurian, 265, 268  
 Silurian–Devonian radiations, 263–65, 279–80, 286–87  
 defining and categorizing, 282–83  
 ecological constraints, 283–84  
 environmental conquests, 283–84  
 key innovations, 284–86  
 Simon, M., 516  
 Single substrates  
 uptake and incorporation of, 510  
 Sipes, SD, 97  
 Size trends, 306  
 Skalinska, M., 472  
 Skeptical mode vs exploratory, 311–13  
 Skew models, 157–58  
*S locus glycoprotein (SLG)*, 6  
 Smith, A., 437  
 Smith, B., 124  
 Smith, SV, 414, 419–20, 424, 426  
 Snakes  
 and the biodiversity crisis in Guam, 114  
 colonizing of Guam, 121–22  
 controlling, 136  
 hunting behaviors of, 122  
 Snow, R., 489  
 Social insects  
 pair-dwelling among, 168  
 Soil fertility, 445  
 Soil organic matter (SOM)  
 carbon in, 446  
 and forestry, 444–45  
 loss of, 444–45  
 Solanaceae, 7  
*Solanum*, 476  
*S. carolinense*, 14  
 Solar radiation  
 competitive inhibitor for, 553  
 Solubility of minerals, 182  
 SOM  
 See Soil organic matter (SOM)  
 Sondergaard, M., 516, 525  
 Sonora Desert Museum, 100  
*Spalax ehrenbergi*, 11  
 Spatial changes in endophytic fungi, 334–36  
 Spatial patterns of endophytic fungal infection, 333  
 Spatial planning and mitigation, 224–26  
 Spearman Rank Correlation, 483  
 Spears, EE Jr, 88  
 Specialist pollinators, 97  
 Speciation, 17  
 in anoxic waters, 555–56  
 by multifurcation, 18  
 in oxic waters, 546, 549–51  
 by star-shaped phylogeny, 18  
 theories of, 10  
 Species  
 divergence time of, 9  
 diversity, 263  
 emergence time of, 9  
 introduced, 113–37  
 multiple codistributed, 49–50  
 recently diverged, 1, 13  
 theories of speciation, 10  
 Species-focused management efforts, 54  
 Species trees not matching gene trees, 17  
 Specificity of endophytic fungi, 323

Sperm  
multiflagellate, 572

*Sphaerocarpales*, 268-69

*Sphaerocodium*, 190

Sphenopsids, 572-73

Spindle formation and function, 474

*Spiranthes diluvialis*, 95

Sponges, 186-87  
lithistid, 191  
platy, 188

Spontaneous polyploids  
allopolyploidy and disturbed  
habitats, 489  
frequency of, 487-89  
more common in hybrid than in  
non-hybrid systems, 487-89

Sporogenesis, 470, 475

Sporophytes, 569

Sprengel, CK, 346, 355

S-receptor kinase (SRK), 6

Stable minima, 295

Stanford, JA, 71

Stanton, NL, 100

Star-shaped phylogeny  
speciation by, 18

Stebbins, GL, 354, 489, 493

Stein, WE, 281

Steiner, KE, 97

Steneck, RS, 382

*Sternotherus depressus*, 29,  
49-50, 54

*S. minor*, 29, 32-33, 49

*S. odoratus*, 29, 32, 35, 37, 49, 52,  
54

Stevenson, DW, 588

Stevenson, LH, 527

Stewart, WN, 573

Stochasticity  
demographic, 86

Stouffer, PC, 89

Stream ecology  
altered by roads, 218  
conceptual models in, 61  
in forestry, 448

*Strizolobium*, 477

Stromatolites, 186, 194

Stromatoporoids, 191

Structural depth trends, 304

Succession, 67

Sucrose, 385

Sugden, EA, 90, 94

Sulfate-reducing bacteria  
methylation by, 543, 558-59

*Suncus murinus*, 114  
irruption on Guam, 122-24

Surface stream biota  
significance of hyporheic zone  
to, 67-68

Surface streams interacting with  
hyporheic zone, 61

Surface waters  
mercury in, 546-55

Survivorship curves, 134

Sustainability issues,  
443-44, 458

*Sylvilagus*, 211

*Symbiodinium*, 196

Symbionts  
microbial, 388-89

Symbioses, 196-97  
See also Photosymbiosis

Symmetry, 348  
importance of, 368  
See also Fluctuating asymmetry  
hypothesis

Symmetry planes, 346-48  
orientation of, 349-50  
See also Floral symmetry

Symmetry preference hypothesis  
of floral symmetry, 358-59

*Symphalangus*, 8

Synapomorphy, 285, 578, 582

Syndrome concept and floral  
symmetry, 354

Synonymous PBR sites,  
17

Syrphidae, 96

Systemic endophytes,  
328-30

Systemic vs localized infections,  
323-24

Szathmáry, E, 294, 304, 309-10

**T**

Taborsky, M, 386

*Taeniopterus*, 578

Takhtajan, AL, 586, 589, 592

*Talpa europaea*, 254

*T. occidentalis*, 254

Targett, NM, 390

Targett, TE, 390

Taxodiaceae, 580

Taxonomic composition and  
growth efficiency, 529

Taxonomy and specificity of  
endophytic fungi, 323

Taylor, DR, 249

Taylor, DW, 588

Teleost fish, 375

Temperature effect on  
bacterioplankton growth  
efficiency, 517-18

Temporal variation in bacterial  
growth efficiency (BGE), 515

Tenore, KR, 384

Teo, LH, 388

Tepedino, VJ, 97, 101

Terminology for floral symmetry,  
348-51

orientation of symmetry planes,  
349-50

synonyms, 348-49

whole vs parts of flowers,  
350-51

Terrestrial colonization, 274

Terrestrial environments  
vertebrate herbivores in, 375-97

Terrestrial turtles, 46

Territorial inheritance, 153, 159,  
165

Tertiary, 48, 53

Testudines, 23, 28-54  
faunal similarity, 51

Tetrapods  
class I and class II genes in, 4

*Thelymitra epipactoides*, 96

Thermodynamic mineral  
solubility product, 182

Thermodynamics  
See Entropy trends

Thiel-Nielsen, J, 516

Thompson, JD, 47, 476

Thrombolites, 185, 194

*Thymus vulgaris*, 251

Time intervals  
converting genetic distances to,  
9

Time line intersections, 9

Titration  
in a gizzard-like stomach,  
386-87  
mechanical, 391  
in pharangeal jaws, 387

T-lymphocytes  
presenting proteins to, 4

Tomato industry  
bumblebees for pollinating, 99

Tommotian, 186

Tooby, J, 236

Tournasian, 194

Toyonian, 186

*Trachemys scripta*, 39, 49, 53

Tracheophytes, 569-75  
euphyllophytes, 572  
ferns, 573-75  
lycopsids, 570, 572  
sphenopsids, 572-73

*Tradescantia canaliculata*, 473

*T. subaspera*, 473

Traffic noise  
levels that disturb birds, 214-15

*Tragopogon*, 489

Transient covariance of fitness and  
sex  
model for sex determination,  
244-45

Transmembrane cation  
transporters, 559

Transmission of endophytic fungi, 332

Transportation policy and planning, 223–26  
environmental policy  
dimensions, 223–24  
road-effect zone, 226  
spatial planning and mitigation, 224–26

Transporters  
See Cation transporters

Transport of nutrients and growth efficiency, 524–25

Trans-species polymorphism (TSP)  
balanced, 4–17  
molecular, 1–18  
neutral, 2–4  
nonbalanced, 4  
in other genetic systems, 8  
significance of, 17–18

Trees  
See Phylogenetic tree; UPGMA trees

Trend studies  
See Large-scale trends

Triassic, 196–97, 269, 572, 580–81

*Trichopitys*, 581

*Trifolium pratense*, 475–76

*T. reflexum*, 97

“Triploid block,” 478

Triploid bridge pathways, 467  
for generating new polyploids, 483–87, 493

Triploid formation  
effectiveness of unreduced gametes in, 478–81  
and euploid gametes, 481–83

Triploid pollen, 481–82

Trivers, RL, 164, 243, 245

*Trophus*, 3

Tryptic peptide mapping, 5

TSP  
See Trans-species polymorphism

*Tubiphyses*, 187–88

Tunnel designs, 225

Turbulence, 60

Turley, CM, 518

Turtles, 23–55  
freshwater, 29–45  
terrestrial, 46

Twilley, RR, 414

Tyagi, BR, 472

**U**

Ultraoligotrophic oceans, 513

*Ulva lactuca*, 386

Uncoupling between catabolism and anabolism, 508

Unequal image projection hypothesis of floral symmetry, 356–57

Unreduced gametes  
environmental factors affecting frequency, 477  
frequency of, 475–76  
genetic factors influencing production of, 476  
genetic variation for, 476–77  
and the origin of new polyploids, 474–78, 494  
in triploid formation, 478–81

Untranslated region  
See 3' untranslated region

3' untranslated region (3'UTR)  
mutations in, 2  
single-base pair substitutions, 3  
three-base pair (bp)  
insertion/deletion, 3

Unweighted pair-group method  
See UPGMA

UPGMA (unweighted pair-group method with arithmetic mean) trees, 10–11

Uptake and incorporation of single substrates pattern in bacterial growth efficiency (BGE), 510

Upwelling water promoting algal activity, 67

*Urus*, 222–23

US Forest Service (USFS), 438  
cooperatives with universities and industry, 442

UTR  
See 3' untranslated region

3'UTR  
See 3' untranslated region

*Uvularia grandiflora*, 477

**V**

Vacancies  
ability to exploit, 153

Valentine, JW, 303

van der Pijl, L, 366–67

Van Valen, LM, 305

Variable fitness of males and females  
model for sex determination, 245–46

*Varroa jacobsoni*, 92–93

Vascularization, 266

Vascular plants, 270  
basal tracheophytes, 569–75  
lignophytes, 575–86  
phylogeny of, 567–95

Vegetation adjacent to roads, 210–11

Vegetation management for improving forest growth, 441–42

Vehicle effects on populations, 212–16  
habitat fragmentation, 215–16  
road avoidance, 214–15  
roadkilled animals, 212–14

Vehrenkamp, SL, 153

*Verbascum*, 350

Vermeij, GJ, 294, 300–1, 309

Vertebrate herbivores, 375–97  
diet quality, 381–86  
habitat comparisons, 380–81  
nutritional ecology of, 375–97  
size structure, 378–80  
species diversity, 378–80

Vertebrates  
food webs of, 126–28  
jawed, 1  
native terrestrial on Guam, 116–17

*Vicia faba*, 469

Vigilance, 149–50

Vinson, SB, 90

“Vorläuferspitze,” 593

Vulnerabilities  
complexes of, 113

**W**

Wagner, GP, 302

Wakeland, EK, 5

Walker, AG, 590

Walker, JW, 590

Walsh, JJ, 425

Ware, JR, 419–20

Warming episodes, 48

Waser, NM, 363

Watch Trust for Environmental Education, 100

Water and forestry, 448–50

Water residence time, 60

Water runoff from roads, 216–18

Water supplies  
upwelling subsurface, 59

Waulsortian mud mounds, 191, 193–94

Werren, JH, 236

Westerterp, K, 147

Weyerhauser Company, 440

Whitney, G, 166

Wiersum, KF, 443

Wilcoxon Sign Rank test, 480

Wild pollinators

domestication of, 99-100  
effects of agricultural practices  
on, 89-90  
Wilkins, AS, 242  
Wilkins, SD, 387  
Wilkinson, GS, 247  
Willard, DE, 245  
Wimsatt, WC, 303  
Wind entrainment, 546  
Windrowing, 445  
*Wolbachia*, 248-50  
Wolfe, JA, 590  
Wollast, R, 408, 422, 424-25  
Woolfenden, GE, 164

## X

*Xanthipus coralipes*, 329  
*Xiphister mucosus*, 390  
*Xiphophorus maculatus*, 234  
*Xylocopa*, 94, 362

## Y

Yarie, J, 447

## Z

Zahavi, A, 160

*Zea mays*, 483  
Zeimer, RR, 450  
Zimmerman, W, 281  
Zooxanthella, 195  
*Zostera marina*, 414  
*Zosterophyllum*, 270, 570  
*Zosterops japonica*, 99  
Zoufal, R, 386  
Zweifel, UL, 516  
Zygomorphy, 348-50, 348-58  
    medial, 351, 354-55, 368  
    transverse, 350  
Zygotic sex determination,  
    241-42